HALEAKALA NATIONAL PARK CRATER DISTRICT RESOURCES BASIC INVENTORY: VEGETATION MAP OF THE CRATER DISTRICT

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A vegetation map of the Crater District of Haleakala National Park was produced at a scale of 1:24,000 that can overlay a composite of the USGS topographic quadrangle maps that cover the same area. After an initial field reconnaissance, the mapping was carried out using 1:12,000 aerial photographs. The map units were field checked as to the accuracy of the boundary positions and the structural and floristic composition of the vegetation units. The boundaries were transferred to overlays on 1:12,000 prints of NASA false infrared color aerial photographs. These maps served as a base for the final map which was produced with photographic methods.

The mapped vegetation has been classified into 53 structural-floristic communities that are grouped into four structural vegetation-types: forest communities, scrub communities, grassland communities, and high altitude desert communities. Forest communities were defined as areas with the tallest vegetation layer composed of woody vegetation greater than 5 m tall that had at least 30% crown cover. Scrub communities were defined as areas in which the uppermost vegetation layer consisted of woody vegetation greater than 0.3 m but less than 5 m in height with crown cover greater than 30%. Grassland communities were defined as areas in which grass species had more than 30% cover while woody species had less than 30% cover. High altitude desert communities were defined as areas with less than 30% total plant cover.

Cover has been defined by Mueller-Dombois and Ellenberg (1974) as the vertical projection of the crown or shoot areas of a species to the ground and expressed as a percentage of the reference area. In this study, closed cover was defined as greater than 60%, open cover as between 30%-60%, and sparse cover as less than 30%.

The communities were labeled using a combination of symbols derived from generic names or other predominant surface cover that correspond as closely as possible to and are used in a similar manner as those used in Mueller-Dombois and Fosberg's (1974) vegetation map of Hawaii Volcanoes National Park. A total of 19 symbols were used in combinations to classify the vegetation into the 53 structural-floristic communities that were mapped.

Areas for these vegetation communities were generated using an electronic planimeter. Scrub communities had the largest total area of 3691.7 hectares (9122 acres). High altitude desert communities were next with an area of 3119.7 hectares (7708 acres) and grassland communities covered 568.6 hectares (1405 acres). Forest communities had the smallest total area of 164.9 hectares (407 acres).

Using the map as a base, three topographic vegetation profiles were constructed to aid in the interpretation of the map units. The courses of the profiles are shown in Figure 1. These courses were chosen so as to cross as much of the study area as possible while illustrating as much of the range in vegetation-types and environmental factors as possible. Profile 1 runs from Pu'u Nianiau at the Park boundary on the northwestern outer slope at 2087.5 m (6849 ft) elevation to Kilohana on the western rim of the crater at 2926.1 m (9600 ft). Profile 2 runs from Kilohana, across the crater floor, to the eastern rim above Paliku Cabin that separates Haleakala Crater from Kipahulu Valley at 2133.6 m (7000 ft). Profile 3 runs from the southern Park boundary in Kaupo Gap at 1158.2 m (3800 ft) up over Kalapawili Ridge at 2484 m (8150 ft) to the northern Park boundary on the northern outer slope at 2316.5 m (7600 ft).

Profile 1 (Fig. 2) shows a decrease in both mean annual precipitation and mean annual temperature to be associated with the increase in elevation. An apparent effect of the temperature gradient on the vegetation can be seen at approximately 2590.8 m (8500 ft) where the vegetation becomes very sparse and is termed a high altitude desert. This change may be associated with the diurnal frost boundary, above which freezing temperatures occur at ground level every night of the year. Mueller-Dombois (1967) found the diurnal frost boundary to occur at about this elevation on Mauna Loa.

Profile 2 (Fig. 3) shows an increase in mean annual temperature associated with the decrease in elevation, and an increase in mean annual precipitation associated with the west-east orientation. The increase in rainfall is related to a greater exposure to the effects of the predominant northeasterly trade winds. These factors result in a gradual increase in cover and stature of the vegetation from a low growing very sparse vegetation (high altitude desert), through several variations of scrub communities, to a low stature 'ohi'a rain forest.

Profile 3 (Fig. 4) shows a decrease in mean annual temperature associated with the increase in elevation, and an increase in mean annual precipitation resulting from greater exposure to the effects of the northeasterly trade winds associated with the south to north orientation. Also, the lower end of this profile extends below the inversion layer which occurs between 1700 and 2300 m (5000-7000 ft) elevation (Blumenstock & Price 1967). This complex of factors is associated with the occurrence of several forest communities between 1292 and 1890 m (4240-6200 ft) which are unique to this section in the study area.

This variation of the climatic regimes within the Crater District and along these profiles can be viewed graphically on climate diagrams constructed by the method of Walter (1963) (Fig. 5). Mean annual temperature ranges from 17.6°C (64°F) just below the southern Park boundary in Kaupo Gap at 1088 m (3570 ft) elevation to 8.0°C (46°F) at Haleakala Summit at 3055 m (10,025 ft). Mean annual precipitation ranges from 1077 mm (42.4 in.) at the summit to 4508 mm (177.5 in.) at Paliku Cabin at 1945 m (6341 ft) elevation. All five diagrams have a mean monthly temperature curve that shows little seasonal variation indicating a tropical climate at all elevations. Also, all five diagrams show a similar annual pattern of precipitation with the wettest months being January and December and the driest month being June. Drought conditions are indicated if the mean monthly precipitation curve crosses below the mean monthly temperature curve and is indicated on the diagrams by the stipled areas. This occurs at three stations: Haleakala Summit, Haleakala Ranger Station, and Holua Cabin, but only for a short period in June. The mean monthly precipitation curve for Paliku Cabin is above 100 mm for all months and thus indicates a rain forest climate.

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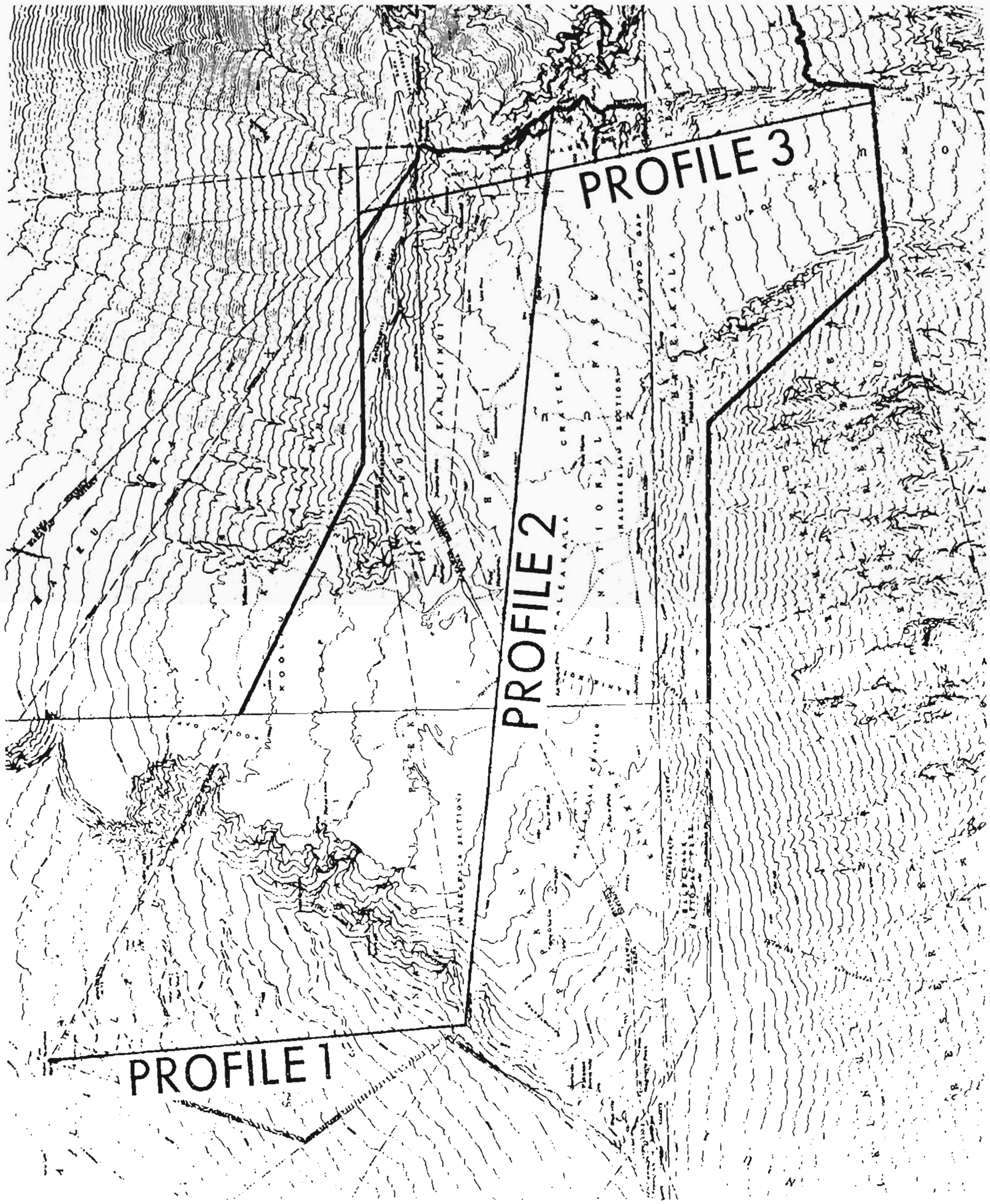


FIGURE 1. Courses of the topographic vegetation profiles of the Crater District of Haleakala National Park.

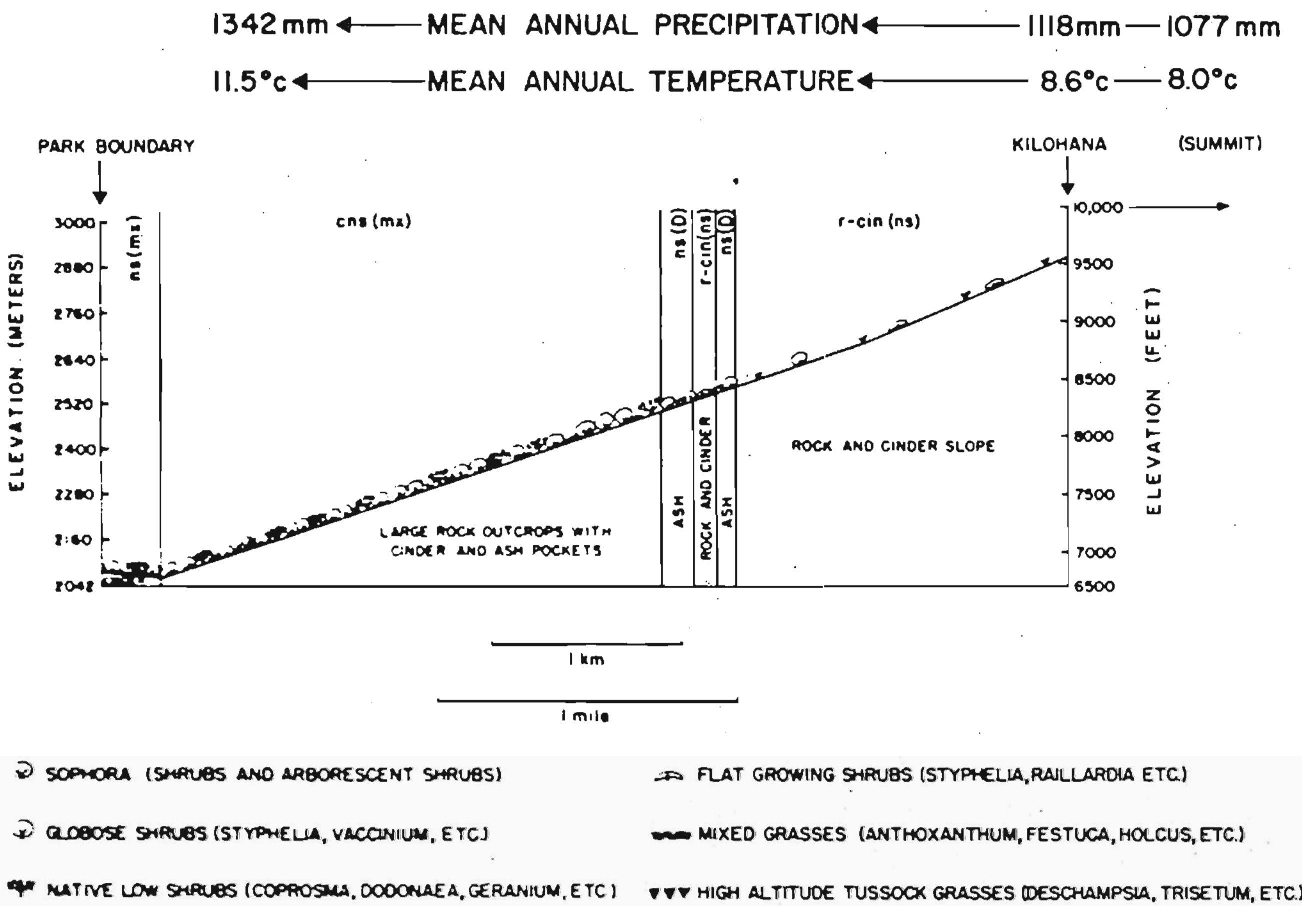
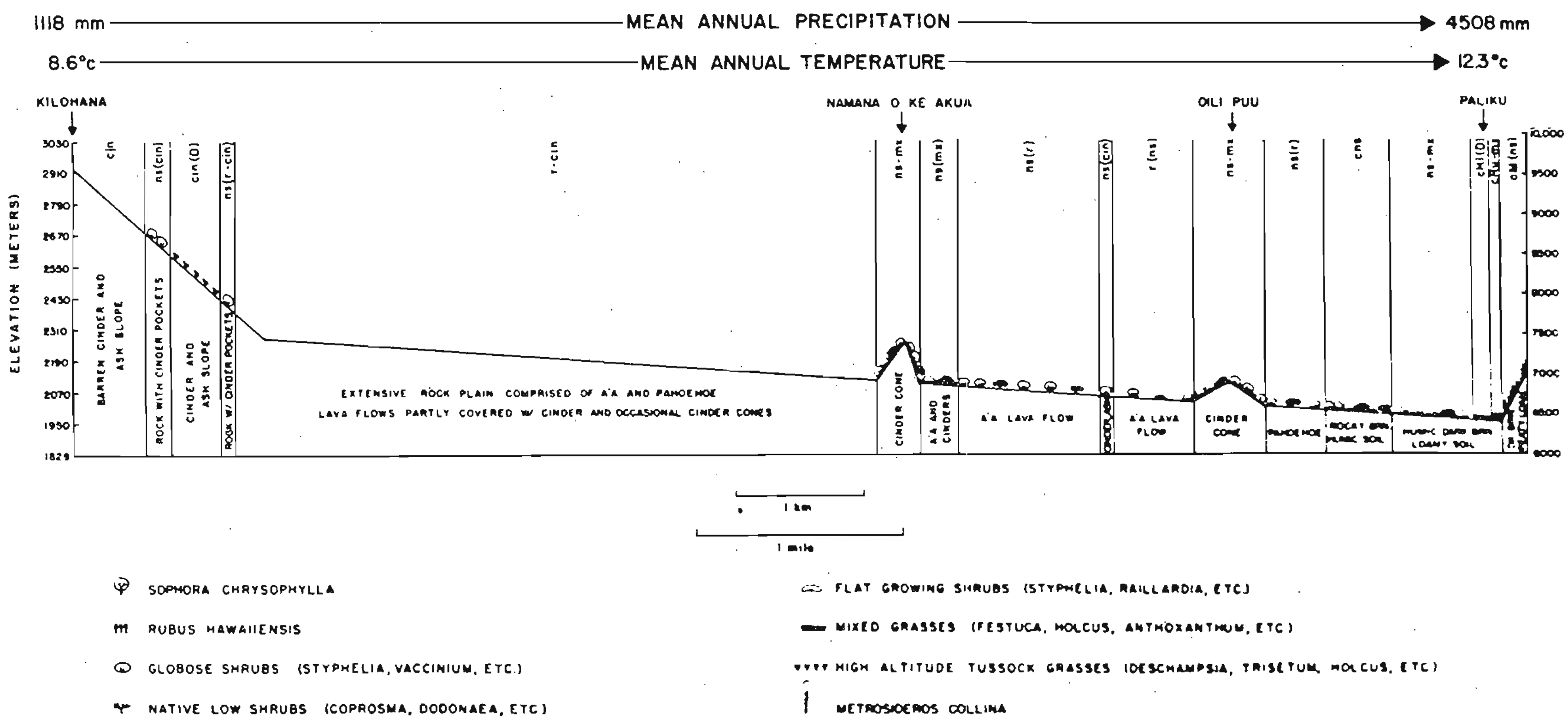


FIGURE 2. Topographic vegetation profile 1 of the Crater District of Haleakala National Park.

FIGURE 3. Topographic vegetation profile 2 of the Crater District of Haleakala National Park.



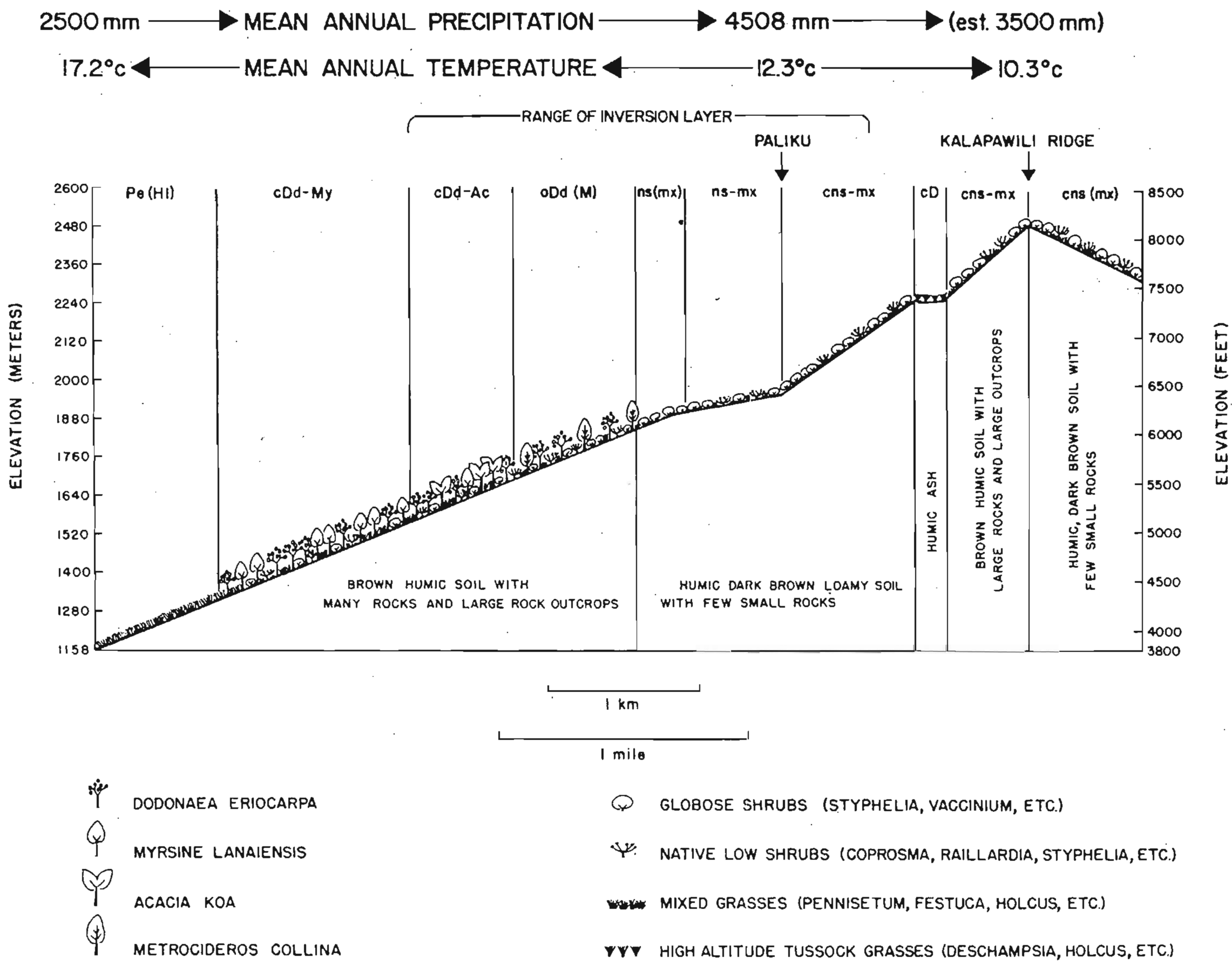


FIGURE 4. Topographic vegetation profile 3 of the Crater District of Haleakala National Park.

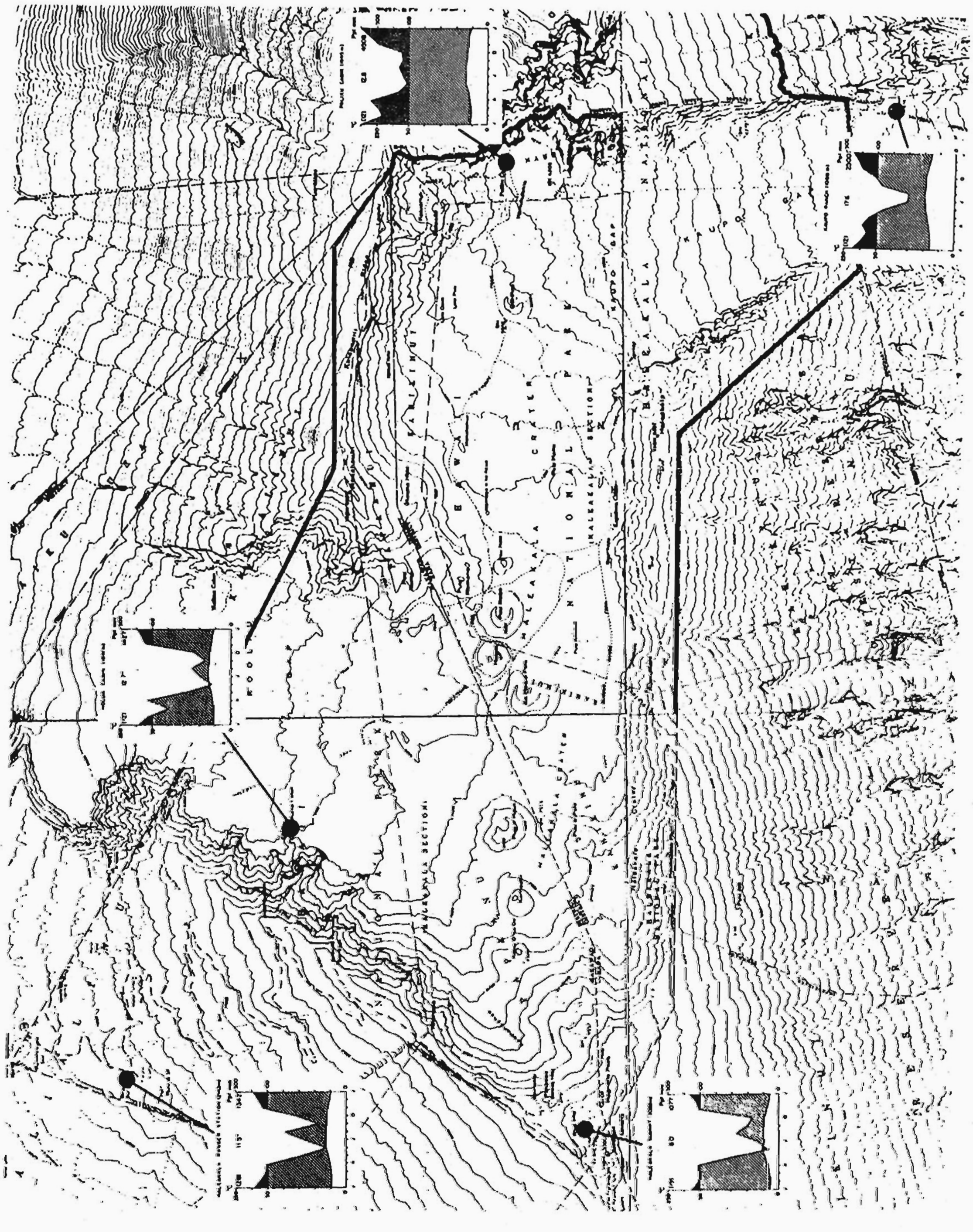


FIGURE 5. Climate diagrams and locations of stations for the Crater District of Haleakala National Park.